## Group D: Fault Prediction and Location Breakout Session (Wednesday, July 20th at 9:40am ET)

# Reminder!!

### Respond to Polling Questions:

**1.** Scan the QR code using your mobile device or;

**2.** Type the following link into any web browser:

**bit.ly/3z7xkgg**

# Question: 1

**Are current data analytic tools (e.g. ML algorithms, AI) sufficiently advanced to deliver the desired system diagnostics (prediction and location of faults) as long as we have enough data? In other words, is it obtaining the data set or is it the data analytics tools that poses the greatest challenge, both, or something else?**

# Question: 2

**Would a 15-mile underground three-phase, single-core test feeder main that emulates a distribution system with multiple joints and branches, switchgear, parallel lines, changing grid conditions, specified manhole or handhole accesses, and definitions of ambient and electrical noise generators, provide a good notional test system for comparing incipient fault detection systems? What other challenges should be included in a notional underground distribution test feeder to prove the efficacy of a fault detection system?**

# Question: 3

Given a notional system such as that outlined in question 2) above, the current consideration is \$100 (total sensing system cost)/phase/mile/year. This cost target would translate to around \$690 M/yr to monitor all MV distribution power lines in the US. What technical advances would it take to achieve this cost target?

# Question: 4

Online partial discharge testing exists for electrical cables, equipment, and accessories today.  Why shouldn't we expect the market to compel the technologies to develop on their own so that they are smaller, more affordable, and can monitor in place in real time? What technology breakthroughs might hasten their market acceptance?

# Question: 5

**How and where should the underground incipient fault detection sensor systems send the large amount of data it collects? Can data be sent over the copper/aluminum power lines? Should data communications and management be part of the program metrics? Who should own the data?**

# Question: 6

**Could an embedded optical fiber in a MV distribution cable become a new standard? If so, is this a near term (i.e. in 5 years) or long term (i.e. in 20 years) expectation? Should the potential program scope include fiber optic sensing technologies assuming that the distribution cables will have optical fibers by default in the future?**

# Question: 7

**Are there specific fault predicting/locating technologies that can adapt to evolving distribution grid topology and constantly changing loads?**

# Question: 8

**Are there other applications that could benefit from new cable fault diagnostic systems developed in this potential program?**

# Question: 9

**Is it necessary to consider real-time mapping of the distribution system to aid in fault location? Why or why not?**

# Question: 10

What are the pros/cons of low-cost distributed sensors vs. localized sensors with a long monitoring range but at higher price? Is one better than the other in terms of value proposition for power utilities or technology advantages for identifying and locating incipient faults?

# Poll Question: 1

**What factors have the greatest influence on the signal-to-noise ratio for electrical and electromagnetic measurements (rank)?**

a) Common-mode noise
b) LEDs
c) Network switching actions and transients
d) Sub-harmonics
e) Supra-harmonics
f) Other? (Please specify)

# Poll Question: 2

**What or where should the diagnostics monitor?**

a) **Along the cable**
b) **Along the conduit**
c) **At the joints**
d) **In the switchgear or other existing equipment**
e) **In the manhole**
f) **Other? (Please specify)**

# Poll Question: 3

**What would have the most impact to monitor for MV underground power cable systems (rank)?**

a) Voltage and current waveforms with <200 samples/cycle
b) Voltage and current waveforms with >200 samples/cycle
c) Temperature at joints and accessories
d) Temperature along the cables
e) Moisture levels inside equipment
f) Acoustic signals (strain) along the cables
g) Gases
h) Other? (Please specify)

CHANGING WHAT'S POSSIBLE

# Poll Question: 4

**What should be the desired output of an 'affordable' underground diagnostics system (rank)?**

**a) Probability of failure**

**b) Location**

**c) Estimated remaining lifetime**

**d) Other? (Please specify)**

# Poll Question: 5

**What are some achievable numerical metrics related to the above-mentioned outputs (write-in for each)?**

**a) Advance notice of failure _____ (minimum notice time to actual failure)**
**b) Location accuracy ______ (% error per a length of cable monitored)**
**c) Percentages of false negatives____**
**d) Percentage of false positives_____**
**e) Other? (Please specify) ____**

# Poll Question: 6

**Which types of cables should be the *focus* of this program (select multiple)?**

a) **PILC**
b) **EPR, TRXLPE**
c) **XLPE, HMWPE**
d) **EPDM**
e) **single core**
f) **three core**
g) **35 kV**
h) **4 kV,**
i) **all of the above**
j) **Other? (Please specify)**

# Poll Question: 7

**What are the desired range and resolution of a monitoring system?**

a) **Fault within 10 feet, detected 1 day ahead of failure**
b) **Fault within 100 feet, detected 10 days ahead of failure**
c) **Fault within 1000 feet, detected 100 days ahead of failure**
d) **Other? (Please specify)**